

# BARTH-HAAS GROUP

## CO<sub>2</sub> Hop Extract

### General:

CO<sub>2</sub> Hop Extracts have been prepared from natural hops or hop pellets using carbon dioxide and contain the  $\alpha$ -acids,  $\beta$ -acids and essential oils of hops. The extract is processed according to the ISO 9001:2000 standards and a HACCP concept. It is classified by the U.S. FDA as a hop extract and are generally recognized as safe (GRAS) in accordance with Regulation 21 CFR 182.20.

### Characteristics:

CO<sub>2</sub> Hop Extract retains the aroma and the bittering potential of the hops from which it is made. Stability is excellent. Compared to raw hops or hop pellets the extracts represent a convenient and concentrated alternative. Since the brewing characteristics of the original hops are maintained, an early addition to the kettle imparts mainly bitterness while late addition will result in a carry over of the volatile oils in beer with aromatic "late hop" character.

### Product specifications:

<b>Description:</b>	Depending on the extraction conditions and the variety the colour of the extract can vary from yellow to dark green. It is a semi-fluid syrupal paste at room temperature. The product becomes more fluid when warmed up.
<b>Viscosity:</b>	approx. 1 – 3 Pas at 30 – 40 °C (86 – 104 °F), (depending on variety).
<b><math>\alpha</math>-acids:</b>	Range for aroma hops approx. 35% and >50% for high alpha hops (depending on variety)
<b><math>\beta</math>-acids:</b>	15 - 40% (depending on variety)
<b>Hop oils:</b>	3 – 12 ml/100 g (depending on variety)
<b>Density:</b>	0.9 – 1.0 g/ml
<b>Pesticides:</b>	Meets current EU and US FDA regulations
<b>Heavy Metals:</b>	Meets current EU and US FDA regulations

### Process specifications for supercritical CO<sub>2</sub> Hop Extract :

Carbon Dioxide Quality:	food grade CO <sub>2</sub>
Extraction temperature:	50 – 60 °C (122 – 140°F)
Extraction pressure:	150 – 300 bar

### Process specifications for subcritical (liquid) CO<sub>2</sub> Hop Extract :

Carbon Dioxide Quality:	food grade CO <sub>2</sub>
Extraction temperature:	5 – 15 °C (41 – 60°F)
Extraction pressure:	55 – 70 bar

**Product Use:**

For efficient provision of bitterness, the extract should be added to the kettle at the beginning or up to 10 minutes after the beginning of the wort boil. Utilisation of  $\alpha$ -acids in beer is slightly better compared to non-isomerized pellets and within the range of 32%-38%. Added late in the boil utilisation of  $\alpha$ -acids may be reduced considerably. The quantity to be added is calculated using the  $\alpha$ -acids content and the estimated utilisation. Actual utilisation may vary depending on plant and processing parameters. If added by means of an automatic dosing system, the extract should be warmed up to 40 °C and gently agitated to ensure proper dosing.

**Packaging:**

Standardisation of the alpha acid content can be achieved by adjusting the weight of extract in each container. Alternatively, the alpha acid content of the extract can be standardised by the addition of a glucose syrup or some other food grade material. Container sizes range from 0.5 to 4 kg. Non-returnable bulk containers are available in sizes ranging from 50 to 200 kg. Containers meet all food industry packaging regulations. When bulk containers are supplied for automatic dosing units, viscosity analysis maybe provided on request. All internal surfaces of containers are lined with a food grade coating.

**Storage and shelf life:**

CO<sub>2</sub> Hop Extract is exceptionally stable when properly stored. Hop oils are preserved in the condition as they were in hops. CO<sub>2</sub> Hop Extract should be cold stored at 0-5°C (32-41°F) and should be used within 8 years after processing. If stored at ambient conditions (below 25°C, 77°F) extracts should be used within 3 years. Containers once opened should be used within a few days.

**Analytical Methods:**

The determination of  $\alpha$ - acids comprises two types of methods, the specific measurement of  $\alpha$ - acids by means of HPLC and conductometric methods

**Concentration of  $\alpha$ - and  $\beta$ -acids:**

The concentrations of these hop resin acids are measured by:

- ◆ HPLC, using the current ICE standard, according to the EBC 7.7 or the ASBC Hops-14 methods.
- ◆ Conductometric methods – EBC 7.6, or ASBC Hops-8 and spectrophotometric method ASBC Hops-6 can also be used.

**Concentration of Hop oils:**

Hop oil concentration can be determined by EBC 7.10 and ASBC Hops-13.

**Safety:**

CO<sub>2</sub> Hop Extract is a natural, non-toxic substance and may be safely handled using routine precautions to avoid contact with skin and, particularly, eyes. For more information please download the relevant Material Safety Data Sheet (MSDS).

**Technical Support:**

We will be pleased to offer help and advice on the use of CO<sub>2</sub> Hop Extract in brewing.

## Isohop®

### General:

Isohop® is a solution standardized to 30% w/w iso-alpha acids which is produced from CO<sub>2</sub> hop extract using an all aqueous process. Isohop® is classified by the U.S. FDA as a modified hop extract that may be safely used in beer in accordance with regulation 21CFR 172.560(b)(2-5).

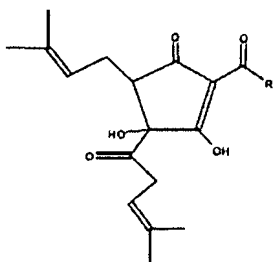


Fig. 1: Chemical structure of iso-alpha-acids

### Characteristics:

Iso-alpha acids are the native bittering acids that are found in traditionally hopped beer. Isohop® is used to replace bittering hops for utilization or economic reasons and to adjust bitterness in beers that were underhopped in the kettle. The active ingredient in Isohop® is the same compound that is formed when traditional hops are used in the brewkettle. For precise control of beer bitterness, Isohop® should be added post-fermentation to adjust the bitterness of the beer to the target BU. It may also provide an economic alternative to kettle hopping when high-gravity brewing. When hopping does not go according to plan, Isohop® will help to get back on target. Isohop® will contribute to foam stand and cling in the same way that traditional bitter hopping will (leaf, pellets, or CO<sub>2</sub> extract). Isohop® will also act as a natural antimicrobial agent when added to beer. Isohop provides a very good utilisation along with comparatively low costs.

**Product specifications:**

<b>Description:</b>	An pale yellow to amber aqueous solution of the potassium salts of iso-alpha-acids
<b>Concentration:</b>	Standard concentration is 30.0% $\pm$ 0.5 of iso- $\alpha$ -acids by HPLC
<b>pH:</b>	8.0–10.0
<b>Density:</b>	1 075 kg/m <sup>3</sup> (+5) (at 20°C/68°F)
<b>Viscosity:</b>	16.08 mPas (at 20°C/68°F)
<b>Solubility:</b>	Soluble in water (at pH 8-10) and alcohol
<b>alpha-acids:</b>	< 0.7%
<b>beta-acids:</b>	< 0.3%
<b>Heavy metals:</b>	Meets current EC and US FDA regulations
<b>Lead:</b>	Meets current EC and US FDA regulations

**Product Use:**

Isohop® is normally used after fermentation and before final filtration. Utilization of Isohop® in final beer is between 60-90% depending on the time and efficiency of dosing. (If Isohop® is used in the brewhouse utilization may drop to approx. 50-60%). The point of addition should be close to a region of turbulent flow, e.g. on the suction side of a centrifugal pump. The pump should be adjusted to deliver the Isohop® over approx. 70% of the total transfer time. It is advisable to make the addition prior to the final filtration step. Local high concentrations of iso- $\alpha$ -acids should be avoided and the addition point should be well separated from that of any other additives. Isohop® may be added at ambient temperature, without prior dilution, directly to beer. If dilution is necessary, the use of demineralized water and a pH adjustment to 9-10 (with KOH) is advisable. Do not use sodium bases to adjust the pH of deionized water – caustic soda or sodium hydroxide form insoluble complexes with most hop acids.

The amount of Isohop® is calculated based on the product concentration and the assumed utilisation. Conducting trials at the brewery will determine the correct dosage of Isohop® in regard to sensory bitterness. Isohop® will give the natural bitterness of unreduced iso- $\alpha$ -acids. We recommend to clean lines and dosing pumps with warm slightly alkaline water or ethanol after use.

**Usage calculations for bitterness adjustment:**

The following calculations are based on an assumed utilisation of 80% when Isohop® is used as recommended (IAA = iso- $\alpha$ -acids).

Desired Sensory Bitterness Units = B

$$\text{IAA to add (80\% utilisation)} = B \times \frac{100}{80} = x \text{ mg/l}$$

$$\text{Dosage in g IAA/hl of beer} = B \times \frac{100}{80} \times \frac{100}{1000} \text{ g/hl} = x \text{ g/hl}$$

Amount of Isohop® in g/hl:

$$(30\% \text{ IAA w/w}) = B \times \frac{100}{80} \times \frac{100}{1000} \times \frac{100}{30} \text{ g/hl} = x \text{ g/hl} = B \times 0.42 \text{ g/hl}$$

Amount of Isohop® in ml/hl:

$$(30\% \text{ IAA w/w}) = B \times \frac{100}{80} \times \frac{100}{1000} \times \frac{100}{30} \text{ g/hl} = x \text{ g/hl} = \frac{B \times 0.42 \text{ g/hl}}{1.075 \text{ g/ml}} = B \times 0.39 \text{ ml/hl}$$

(e. g. for 5 desired sensory bitterness units  $5 \times 100/80 \times 100/1000 \times 100/30$  2.1 g/hl are necessary)

**Packaging:**

Normally in high density polyethylene containers of 20 kg or 10 kg. Larger package units are available on request.

**Storage and shelf life:**

Isohop® has good storage stability. Store in full, closed containers at 2 - 8 °C (36-46°F). Protect the product from light. Isohop® will maintain its quality for at least 18 months if stored as recommended, therefore please read our storage guidelines.

**Safety:**

Any material coming into contact with the skin should be washed off with soap and water. For more information download the relevant Material Safety Data Sheet (MSDS).

**Analytical Methods:**

The determination of iso- $\alpha$ - acids comprises two types of methods, the specific measurement of iso- $\alpha$ - acids by means of HPLC or conductometric/spectrophotometric methods. In regard to the conductometric/spectrophotometric methods please note that the optical density multiplication factor has to be adjusted (70 instead of 50).

- EBC 7.8 for Iso- $\alpha$ -acids,  $\alpha$ -acids,  $\beta$ -acids by HPLC
- EBC 7.9 for Iso- $\alpha$ -acids

**Technical Support:**

We will be pleased to offer help and advice on the use of Isohop® in brewing.